Forward Physics Facility: recent updates towards the Snowmass paper and beyond

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Far-forward LHC experiments

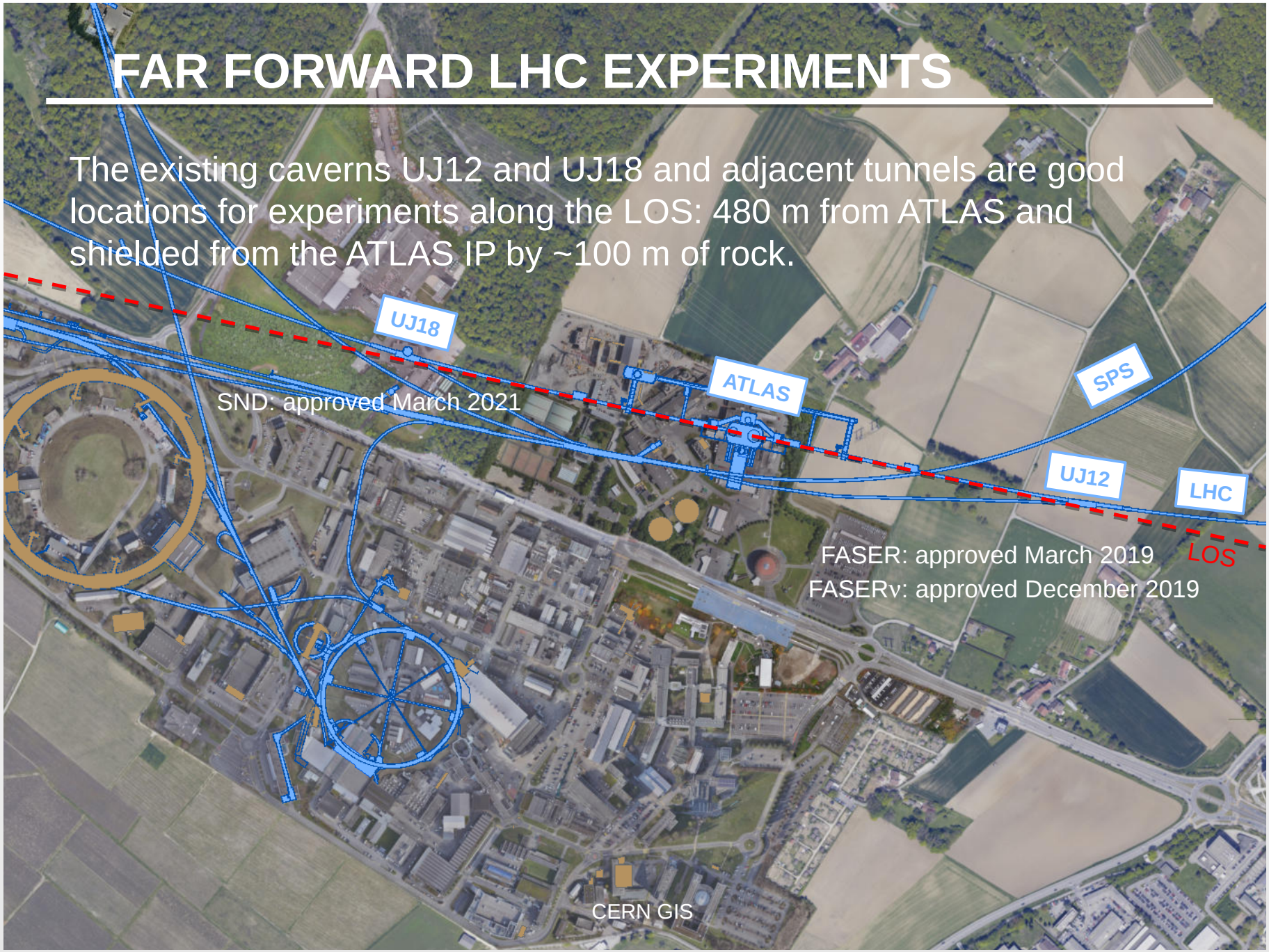
* Various projects to exploit beams of ν, μ, LLP produced in/close to the interactions points at the LHC, propagating in the direction tangent to the accelerator arc.

* Let these beams propagating for some distance, until they interact with the material of one or more detectors.

* Pilot experiments, on the tangent to the LHC beam line, at $\sim$ 480 m from ATLAS IP:
  - FASER, Faserν will take data during Run 3.
  - SND@LHC was approved this spring and is also supposed to take data during Run 3.

FAR FORWARD LHC EXPERIMENTS

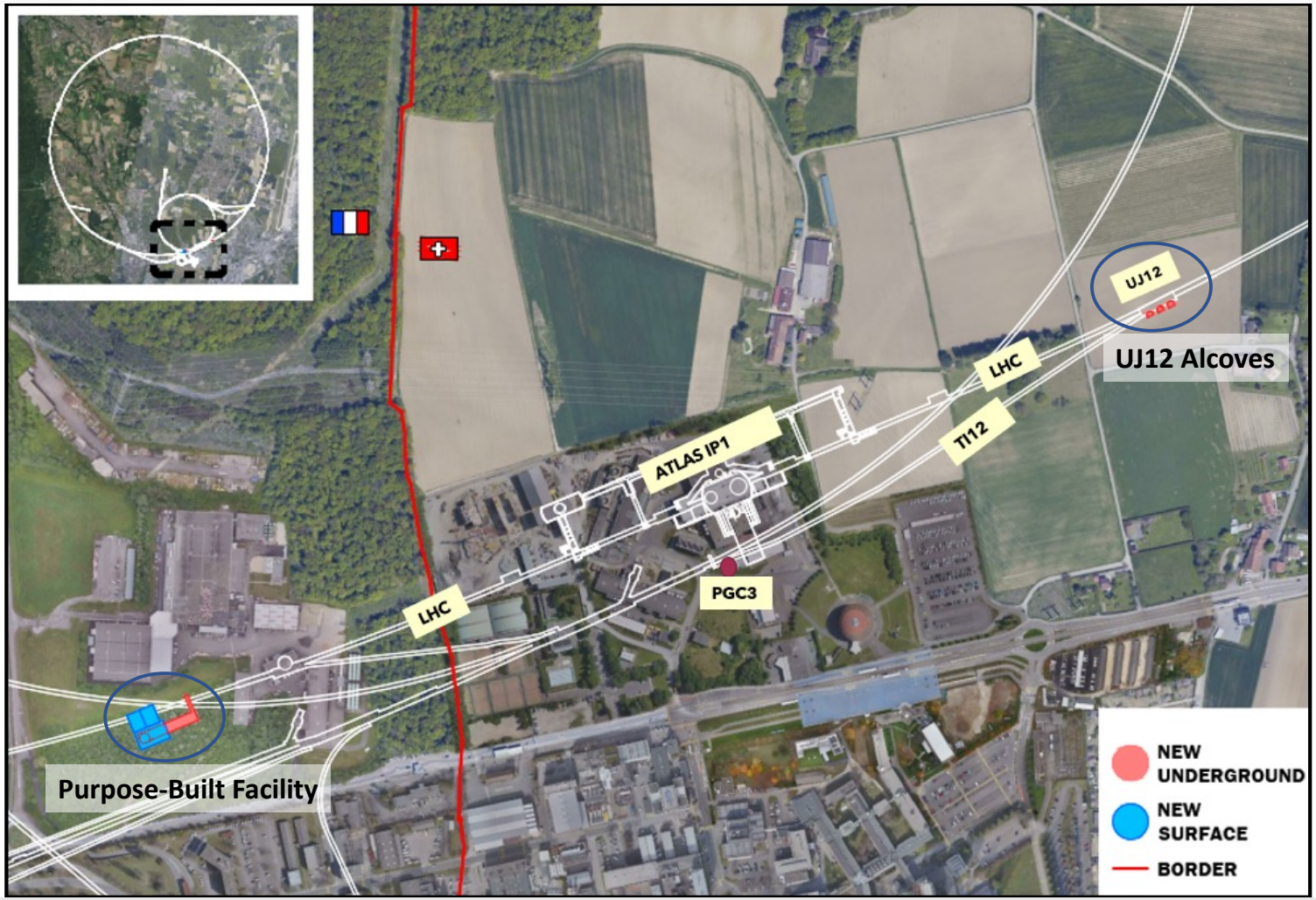
The existing caverns UJ12 and UJ18 and adjacent tunnels are good locations for experiments along the LOS: 480 m from ATLAS and shielded from the ATLAS IP by ~100 m of rock.



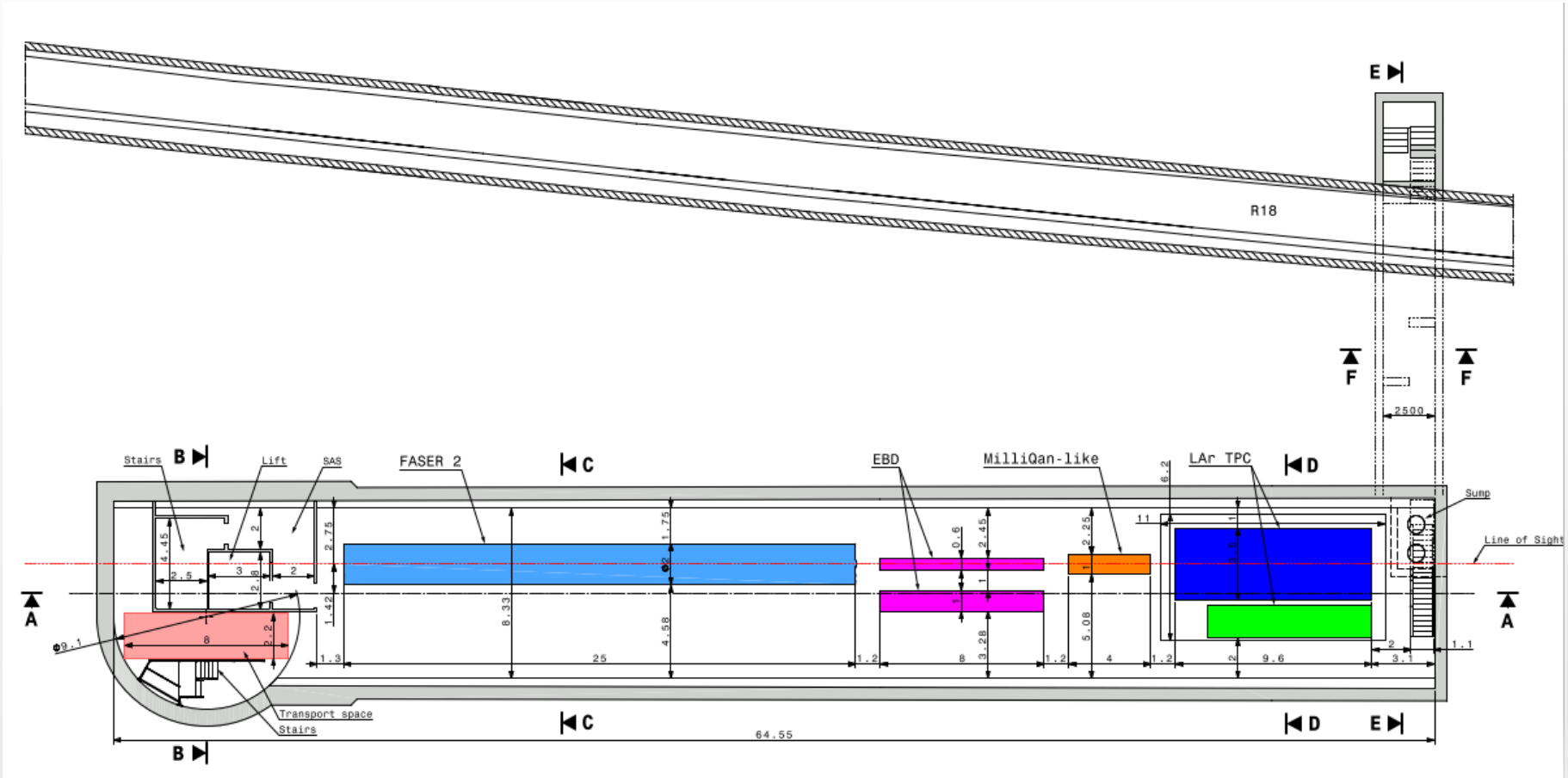
The Forward Physics Facility @ HL-LHC

Site alternatives under investigation:

- enlarge UJ12 with alcoves
- create a new shaft and cavern at 600-700 m from ATLAS past UJ12.



The Forward Physics Facility @ HL-LHC: purpose built facility and experiments



Suite of experiments using different technologies at different rapidities, dealing with far forward ν, μ and BSM LLP particles.

QCD opportunities at the FPF (EF06/EF05/EF07)

* far forward light-flavour and heavy-flavour production and decay
* proton PDFs (small x, large x) through charm production and decay
* nuclear PDFs, mainly through ν and $\bar{\nu}$ DIS on a variety of targets
* complementarity with other experiments (EIC, LHeC, HL-LHC, etc....)
* "hybrid" factorization framework (including resummation of high-energy logarithms) vs collinear factorization framework
* constraints on non-perturbative models in event generators for particle and astroparticle physics.
* further connections with astoparticle physics:
  lepton fluxes at the FPF $\leftrightarrow$ ν, hadron production in the atmosphere.

Example:
$\mathcal{O}(10)(\pm\, \textit{uncertainties}...)$ ν_τ CC DIS events at Faserν + SND@LHC
will become
$\mathcal{O}(1000)(\pm\, \textit{uncertainties}...)$ ν_τ CC DIS events at the FPF experiments.

FPF related activities

* Kickoff Meeting: November 2020 ($>$ 100 participants)

* Second Meeting: May 2021 ($>$ 100 participants)

* FPF first paper: close to be ready. At present 70 pages, several tens of authors, 12 topical conveners, describing *Civil Engineering - Experiments - Opportunities for studies of interest in the BSM, Neutrino, QCD and Astroparticle Physics* sectors. To be submitted in arXiv by end of the month and to a journal immediately afterwords.

* Third Meeting - last week of October 2021

* FPF Snowmass paper: long paper to be submitted to the Snowmass process during spring 2022. The authors working on the first paper are going to further devolop their studies. Additional collaboration is always welcome!

* FPF CDR: autumn 2022

* FPF TDR: autumn 2023, to possibly allow for FPF construction during the LS3 (2025 - 2027) and operation during the HL-LHC phase.

In case of interest, please contact the conveners:
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